PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements in Axial Threshing or Threshing and Straw-reducing Machines.

I, Dr. FELIX SCHLAYER, of 17, Calle del Principe, Madrid, Spain, a German citizen, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an axial threshing or threshing and straw-reducing machine, its object being to effect certain improvements in the device for separating the grain from the straw.

Machines of the kind referred to have the peculiarity of discharging the materials in a plurality of separate streams issuing one behind another along the machine drum. This is particularly the case with machines of the Schlayer type, wherein, owing to the special arrangement of the rotary beaters and stationary abutments, the materials are first subjected to a lenient treatment which discharges the loose and heavy grains, the threshing being gradually intensified as the materials travel through the drum at the end of which the straw is torn and reduced.

In contradistinction to known constructions wherein the materials are discharged together in a single stream and require spacious devices and a considerable expenditure of power for a subsequent separation and dressing, the present invention consists in incorporating with the machine a separating device whereby each particular stream of differently conditioned materials is separately treated. After the different streams have thus been subjected to a substantially uniform preliminary dressing, they are preferably collected and subjected together to a final dressing. The invention allows the grain to be separated from the extraneous matter in a much more economical manner than before.

The particularly advantageous construction of the machine is obtained by arranging the blower shaft of the winnowing device parallel or nearly so to the longitudinally disposed threshing and straw-reducing drum. The grain dressing can then be carried out almost entirely by means of the wind from the blower, the function of the sieves being principally to obstruct the falling movement of the materials and prolong the action on the latter of the wind. When the materials issue from the drum, the lighter parts thereof will immediately be caught by the wind and carried away. As compared with machines wherein the blower is arranged transversely beneath or behind the drum, the novel blower arrangement has the further advantage that the machine can be built much lower and shorter and that it can thus be more easily supervised. Naturally the more the wind gains in importance in the dressing of the materials, the greater will be the effect of variations in the strength of the same. Care must therefore be taken to maintain a constant speed of the beater shaft. This can easily be effected by rendering the feed uniform. Since the drum of an axial threshing machine, unlike the ledge and spike drum machines, does not possess any feed regulating cage which prevents the entrance of thick bundles of material, it is evident that a careless feeding will result in irregular movement of the machine. Such irregularity has a detrimental effect on the generation of wind and thus on the functioning of the winnowing device. It is therefore necessary to provide means for rendering the feed uniform and this is effected by the provision of a regulator which evens out thick bundles into thin uniform layers. This regulator consists of a box-shaped automatic feeder containing a conveying device comprising a rapidly moving endless band and a retarding element arranged under said band.

Fig. 1 of the accompanying drawings represents a longitudinal section of the machine,

Fig. 2 shews a plan of the same,

Fig. 3 is a rear view of the machine,

Fig. 4, a section on the line IV—IV of Fig. 2,

Fig. 5, a section on the line V—V of Fig. 2,

Fig. 4a shews a blower mouth in section on an enlarged scale,

Fig. 6 is a longitudinal section through the feed regulator,

[illegible]

Fig. 7 is a section on the line VII—VII of Fig. 6,

Fig. 8 shews a development of the vaned roller,

Fig. 9 is a part section on the line IX—IX of Fig. 6, and

Fig. 10, a partial plan of Fig. 6.

1 is an axial threshing and straw-reducing machine of the Schlayer type, wherein the rotating beaters 3 fixed to the beater shaft 2, are at the inlet end at a certain radial distance from the fixed abutments 5 arranged on the machine casing 4, the distance becoming smaller and smaller towards the discharge end of the machine where they intermesh for the reduction of the straw. I denotes the threshing zone, II the preliminary reducing zone, III the final reducing zone, and IV the short straw outlet.

The machine drum 4 is carried by frame 6 which rests on removable running wheels 7 and is provided in its lower portion with adjustable feet 8 on which the machine stands during operation. On a front and middle transverse portion of the frame 6 there are bearings 9 for the beater shaft 2 which carries on its front end the driving belt pulley 10 and on its rear end a preferably axially adjustable disc 11. The latter allows the chopped straw to issue between its somewhat conically shaped rim and the wall of the final reducing chamber, whilst it has on the hub a concentric opening for admitting the additional air which is interrrupted only by the spokes of the disc. This additional air flows to the hub opening from the rear end of the machine through a cylinder-like attachment 12 which passes through the hood 13 surrounding the short straw outlet.

The feed trough 14 is located laterally of the threshing drum. Arranged at the same side of the machine with the blower shaft parallel to the threshing and reducing drum 4 there is arranged the blower for the winnowing device, the bearing 15 for the blower shaft 16 being fixed on the side portions of the frame through the intermediary of small stands. The blower is formed of two co-axially arranged single blowers 17, 18, lying one behind the other, the wing-vanes 19 of which are all mounted on the shaft 16. The front blower portion 17 extends from a position somewhat behind the front wall of the machine up to the end of the final reducing chamber III. The second blower portion extends somewhat from the first third part of the hood 13 up to the rear transverse portion of the frame 6 located at a certain distance from the hood. The blower shaft 16 is connected with the beater shaft 2 by belt drive 20.

Beneath the threshing and reducing drum 4 and stretching towards the side turned to the blower 17, there is located a preliminary winnowing mechanism 21 which consists of two oppositely moved shaking boxes and which is suspended in front on springs 22 and behind on reciprocating levers 22^1 and executes a movement which is transverse to the machine drum and which is imparted to the swinging levers 22^1 by the blower shaft 16 by means of connecting rods 23. From the sectional representation in Fig. 4, it is seen that the air issuing from the passage 24^1 (formed of adjustable walls) of the blower portion 17 aerates regularly both shaking boxes and can act directly especially on the stream of material which is winnowed and which issues from the discharge opening at the bottom and longitudinally of the drum 4.

As may be seen from the special representation in Fig. 4a, there is located in the discharge portion of the not very short passage 24, a triangularly shaped regulating plate 24^1, which can be rotated about the asymmetrically arranged axle 24^2. With the aid of this plate the blowing air which is uniformly distributed in the inlet end of the passage, may be uniformly or non-uniformly distributed at the moment of issue over both of the outlet portions. Consequently it is possible, as desired, to allow a larger quantity of air to flow through the upper or lower outlet portion or to give it a direction which is inclined more upwards or downwards without wholly shutting up the other outlet portion.

A ledge 21^1 separating the streams of material is placed on the upper shaking box of the winnowing mechanism 21 at the plane of contact between the zones I and II and also, if desired, at the plane of contact between the zones II and III. These ledges may be detachable. 25 denotes a passage which catches the preliminarily winnowed grains and leads to an elevator 26.

A second preliminary winnowing mechanism 27, likewise consisting of two oppositely running shaking boxes movably mounted transversely of the longitudinal axis of the machine, is located below or behind the hood 13. It may be driven from the shaking mechanism 21 to which it should then be rigidly coupled. Preferably, however, a reciprocating lever drive is used in this case also. The two-armed swinging lever 22^1 provided on each side of the box is mounted on a pivot 22^2. Its shorter lower arm directly engages the lower box of the shaking apparatus whilst its longer upper arm is connected with the upper box by means of a connecting rod. The upper box is suspended in front

and behind on springs 22 whilst the lower box rests in front on supporting springs and is carried at its rear end by the reciprocating levers. The position of attachment of the connecting rod 23 pivoted to the blower shaft 16, to the reciprocating lever may be made changeable. The use of reciprocating levers as a portion of the driving mechanism in the case of these winnowing machines, renders it possible to impart to each box a stroke corresponding to its working requirements without the necessity of making adjustments on the common driving shaft 16. The preliminary winnowing apparatus 27 is aerated by the rear single blower 18 and is, if necessary, also adapted to be regulated. The preliminarily winnowed grains fall onto a return floor and pass through the passage 28 to the elevator 26.

The latter is carried to such a height between the blower portions 17 and 18 that it can deliver the grains into a drum 29 which lies above the machine frame 6 parallel to the longitudinal axis of the machine and which serves as an awning and conveying device and moves the grains into the cleaning mechanism 30 located behind the hood 13 above the preliminary winnowing mechanism 27. If beardless corn is being threshed, the grains are fed to the cleaning mechanism 30 by a conveying device 29'.

The cleaning mechanism consists of a single shaking box which is movable transversely to the longitudinal axis of the machine and is suspended on vertical springs and which is aerated by a blower 31 arranged at the end of the awning device. It is driven by a jolting rod 30' which is attached to the connecting rod 23 and which imparts to it a smaller stroke than that imparted to the upper box 27. The sifted corn is collected on the floor 32 and passed to the carrying off outlet 33. Grains or ears that blow over, fall at the end of the bottom 32 into a rearwardly directed hopper 34 which leads them to the upper shaking box of the rear preliminary winnowing apparatus 27. Here it falls onto a surface which is partitioned off by a ledge 27' and which thus remains free from the short straw coming from the hood 13. In this manner all the grains blowing over are subjected to repeated winnowing and arrive in the elevator in a short simple way or pass on to repeated further treatment. 35 represents the drive of the awning or conveying device 29, 29' from the carrying off elevator 26.

The machine operates as follows:

The grain to be threshed is fed through the inlet 14 to the beaters 3 which seize it and lead it travelling through a helical path axially through the machine up to its discharge end. In doing this, it is degrained principally by being hurled against the fixed abutments 5, whilst in zone II it undergoes, on account of the increasing proximity of the beaters 3, a sharper treatment which approaches reduction and which changes in zone III into a disintegrating action of the desired degree.

In accordance with this mode of treatment there issues, through the sieve-like bottom portion of the drum 4 and from the bottom opening of the hood 13, a stream of material which can be regarded as composed of single streams which lie axially behind one another and which consist in the inlet zone substantially only of grains but which, on passing towards the rear end of the machine, carry with them more and more impurities and at the discharge end contain almost entirely short straw.

By means of this novel arrangement of blower and beater drum, the individual streams of material can now be treated directly side by side and transversely to the longitudinal direction of the machine, a feature which is extraordinarily advantageous because the said streams are directly and by themselves individually exposed to the wind current and are more thoroughly winnowed on account of the avoidance of the formation of large mixed streams of material. The effect of this divided or stepwise treatment of the material to be winnowed is enhanced by the movement transversely of the longitudinal axis of the machine, of the shaking boxes which convey the material to be sifted approximately in a straight line, so that without the arrangement of special walls on the sieves, the streams of material to be sifted remain side by side separated and parallel to each other.

Naturally, special circumstances may make it appear advisable to provide one or a number of separating walls. The ledge 21' represented with the front preliminary winnowing apparatus has thus the object of separating, in the case of grains with sharp ear portions which become detached in the inlet zone and are not usable as cattle food, the said ear portions completely from the remaining short straw and to bring them to the notice of the operator.

The short straw issuing from the hood 13 meets a sharply blowing wind current of the machine which sucks up any necessary additional operating air through the attachment 12. The wind current loosens the straw falling on the rear preliminary winnowing apparatus 27 and distributes it over the sifting surface which is entirely aerated by the blower 18.

The grains sifted off in the preliminary

winnowing devices 21 and 27 reach the elevator 26 which conveys them, according to the setting of adjustable guide elements, either into the drum 29 acting as awning device or into the conveying device 29', from either of which they pass into the cleaning mechanism 30. The cleaned grains are carried off at 33. The aeration of the cleaning mechanism 30 is effected by the blower 31 arranged at the end of the awning device 29. The portions of the material blown over arrive through the passage 34 on the sifting surface of the upper shaking box which is partitioned off by the ledge 27'. The invention is also applicable to a machine used for threshing only or to a machine used for reducing only, since even in the latter instance the materials may be sorted out into several streams.

The automatic feed regulator consists of a box 37 which is made of angle and sheet iron and which is placed in front of the inlet opening of the axial threshing machine 1 and is secured in a suitable manner for example, by means of screws 38. The bottom 39 of the box is relatively short and slopes towards the threshing machine. On its front end there is mounted a slowly running roller 40 which has on its circumference two intermixed sets of obliquely placed vanes 41, which diverge at an angle, see Fig. 8. Behind the vane roller there is located a grate-like table 42, the rear end of which is continued as a nose 43 which is offset in the form of a step and projects into the drum of the threshing machine.

In front of the vane roller 40 there terminates the feed conveyor consisting of an endless belt 44 which is kept in a frame 45. The upper belt pulley 46 is adjustable in an approximately vertical direction in a U-shaped bearing 47 of the front wall of the box. Three bearing positions are provided. In the example shewn the belt pulley is located in the middle bearing position. Bolts 48 serve as adjusting members for the bearings. The velocity of the conveying belt 44 exceeds the peripheral velocity of the upper edge of the vanes 41.

On the cover of the box 37 there is located a very rapidly running endless belt 49 which is composed of parallel metal strips and which protrudes forward considerably beyond the vane roller 40. The belt has fingers 50 arranged arrowwise, the arrow tips entering the arrow openings in front of them. The stiffening angle pieces 51 situated in the upper part of the side wall of the box are arranged on the inside of the wall. They fulfil the function of acting as holding members for the belt 49 if the latter should tear. 52 denotes a stretching wheel. A toothed wheel of the shaft 53, which is set in action by the drive 54 from the threshing machine, meshes with a transmission gear 55 which drives the vane shaft 40 and the upper pulley 46 of the conveyor by means of a chain 56.

In the upper portion of the discharge end of the box chamber there is located a swingable finger-like rake 58 which is fixed on the axle 57 and which strips firmly adhering fed material from the belt 49 and carries it down the inlet opening of the threshing machine. The axle 57 is provided at one end with a handle 60 which is adapted to be fixed in position and after the liberation of which the rake falls into the broken line position and leads the material to be threshed between the rear shaft 53 and a rear-box-closing wall 61. This possibility of closing is desirable for the purpose of preventing if necessary the entry of foreign bodies into the threshing machine.

Between the shaft 53 and the drive 54 there is interposed a centrifugal regulator 62 which stops the automatic feed device when the number of revolutions of the threshing machine diminishes too much. It is advisable to mount the vane roller so that it can be removed in order that it may be taken out when threshing tangled grain. In this case the table 42 is advantageously provided with an extension which reaches to about the proximity of the conveyor.

The feed apparatus operates as follows:

The velocities are so chosen that there is imparted to the feeding belt 44, by means of the drive 54 and the connected transmission gear, a certain velocity which is not attained by the upper edge of the rotating vanes 41, whilst the belt 49 runs with a considerably higher velocity.

If the feeding conveyor is in the middle position in front of the feed box 37, the upper part of the sheaves carried up by the belt 44 comes first into contact with the belt 49 above it, the fingers 50 of which grip the upper layers of the sheaves and convey them to the machine and at the same time pull them apart laterally. On running forward further, the fed in material, which decreases downwardly, strikes the roller 40, the vanes 41 of which again lift it into the range of the fingers 50 and at the same time tear apart the lowest portion during the further conveyance of the sheaves to the threshing machine.

If the wheel 46 of the feeding conveyor occupies the lowest bearing position, the distance between it and the rapidly running belt 49 is greater. The sheaf will

therefore come into contact simultaneously at least with the belt 49 and the roller 40 and will in addition strike against its lower half. This slowly running checking roller must consequently lift the sheaf repeatedly into the range of the fingers 50 with the result that it is drawn only slowly into the machine, when the members 41 and 50 again exert a laterally dissevering effect on the thick layer of materials.

In the uppermost bearing position of the feed conveyor the sheaves are mainly gripped only by the belt 49 or its fingers 50 and pulled apart laterally. The arrangement of the feed conveyor at different heights consequently effects in conjunction with the slowly running distributing roller 40 and the rapidly moved conveying belt 49, a larger or smaller stemming of the material being fed in. This affords the possibility of automatically regulating the feed in accordance with the condition of the material to be threshed.

The angularly arranged members 41 and 50 pull the sheaves apart so thoroughly that there results an uninterrupted feed with a thin layer filling the whole width of the feed opening. The attendant need not pay any special attention to the machine but can throw onto the feed conveyor whole sheaves which are treated more rapidly or more slowly according to the setting of the feed conveyor. A rearing up of the sheaves on slowing down does not take place because they are previously caught by the belt 49 above them.

If it be desired to interrupt the feeding of material to the threshing machine—for example in the presence of foreign bodies, the lever 60 is released, whereupon the rake 58 drops down, bars the inlet opening 59 and allows the material to be fed to pass out behind the belt 49. The grains falling on the bottom 39 of the box pass through an opening 63, provided beneath the nose 43, into the threshing machine.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An axial threshing or threshing and straw-reducing machine characterized by having incorporated with it a separating device whereby the differently conditioned streams of materials issuing one behind another along the machine drum, are separately treated.

2. A machine according to claim 1 characterized by the feature that the grains from the separately treated streams of materials are collected and subjected together to a final dressing.

3. A machine according to claim 1 or 2 characterized by the feature that the blower shaft of the separating device is parallel or nearly so to the longitudinally arranged threshing and straw-reducing drum.

4. A machine according to claim 3 characterized by the feature that the air outlet of the blower is situated directly beside and below the outlet made in the machine drum for the materials so that the latter will be caught by the wind from the blower immediately on leaving the drum.

5. A machine according to any of the preceding claims characterized by the feature that the streams of materials issuing from the drum are separated by walls which may be detachable.

6. A machine according to claims 3, 4 or 5 characterized by the feature that the shaking sieves of the separating device are arranged cross-wise relative to the machine and situated beside and below the machine drum.

7. A machine according to claim 6 characterized by the feature that the separating device has at least two winnowing devices arranged in juxtaposition for the separate treatment of the streams of discharged materials.

8. A machine according to any of claims 3—7 characterized by the feature that the blower or blowers are accommodated in the space formed between the machine drum, the sifters and the machine frame.

9. A machine according to claim 7 or 8 characterized by the feature that the blowers of the different winnowing devices differ in size.

10. A machine according to claim 3 or 7 characterized by the feature that the blowers which act on the winnowing devices composed of two oppositely working sifters, are provided with wind distributors which are built into the blower outlets and which determine the magnitude and the direction of the divided wind currents.

11. A machine according to claim 10 characterized by the feature that the wind distributor is wedge-shaped and adjustable about one of its lower edges.

12. A machine according to claim 6 or 7 characterized by the feature that the oppositely working shaking sieves of the winnowing devices are linked to levers which impart to them different working strokes.

13. A machine according to any of the claims 7 to 12 characterized by the provision of an oscillating dressing device for the grain collected from the two winnow-

ing devices, said dressing device being arranged above the winnowing device which is situated behind the outlet end of the drum.

14. A machine according to claims 2 and 13 characterized by the provision of a bucket elevator adapted to convey the grain from the two winnowing devices into the final dressing device.

15. A machine according to claim 14 characterized by the feature that the bucket elevator is arranged between the two winnowing devices and conveys the grain into an awning or conveying drum which bridges the distance between the elevator and the final dressing device.

16. A machine according to claim 15 characterized by the provision of a blower arranged at the outlet end of the awning device so as to supply air to the dressing device.

17. A machine according to claim 13 characterized by the provision of a channel connecting the overflow of the dressing device with the shaking sieve of one of the winnowing devices so as to lead blown-over materials on to a sieve surface which is preferably divided off from the main surface.

18. A machine according to claim 1 having a box-shaped feeder including a conveying device and characterized by the feature that the conveying device comprises a rapidly moving endless band and a retarding element arranged under said band.

19. A machine according to claim 18 wherein the retarding element consists of a roller fitted with diverging vanes adapted to raise the materials and spread them out towards the sides of the feeder.

20. A machine according to claim 18 characterized by the provision on the endless band of arrow-like fingers adapted to convey the materials and to spread them out laterally over the feeder.

21. A machine according to claim 18 characterized by the feature that the endless band overhangs the roller.

22. A machine according to claim 18 characterized by the provision between the rear end of the band conveyor and the drum inlet of an auxiliary outlet below which pivoted rakes are arranged so as to sweep the materials from the band, the rakes being adapted to lead the materials from the drum towards the auxiliary outlet.

23. A machine according to claim 18 characterized by the provision at the upper part of the two side walls of the box, of members adapted to strengthen the latter and to prevent the band, on breaking, from being fed into the machine drum.

24. A machine according to claim 18 characterized by the feature that the upper roller of the conveying band is vertically adjustable relative to the feeding roller and adapted to run at a higher speed.

25. A machine according to claim 18 characterized by the feature that the conveying band of the feeder is carried to the neighbourhood of the drum inlet and works under a rake or the like which, instead of the feeding roller, effects the lifting and detention of the materials.

Dated the 24th day of January, 1929.

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SHEET 1

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Fig. 1.

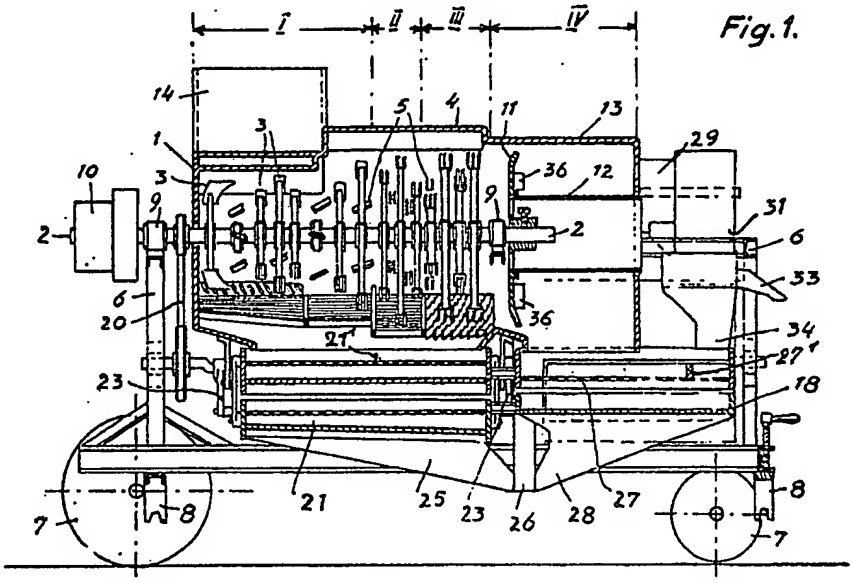


Fig. 2.

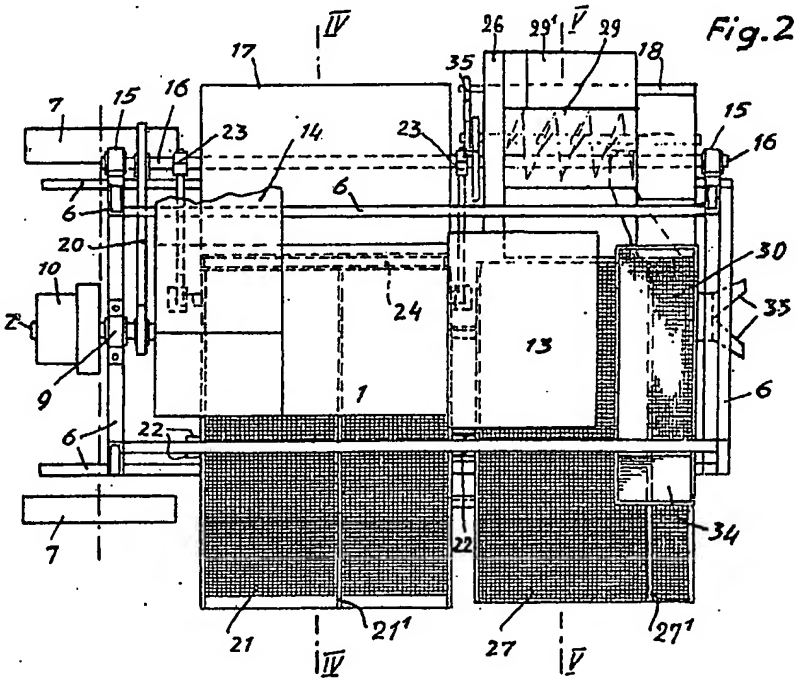


Fig. 4a

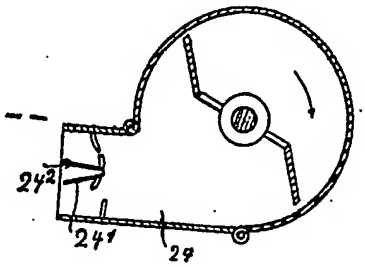


Fig. 3.

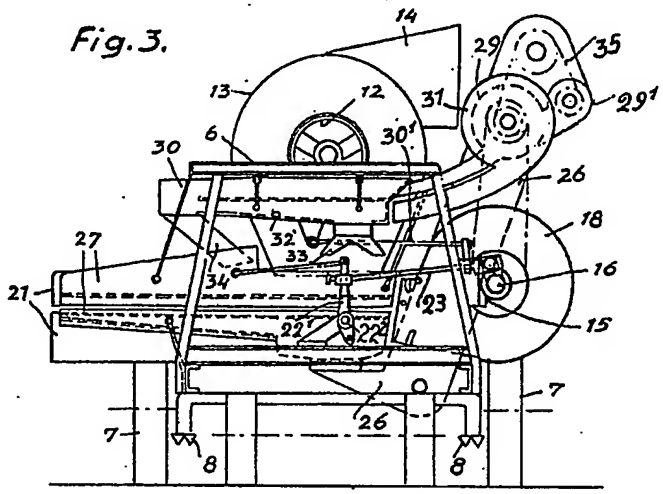


Fig. 4.

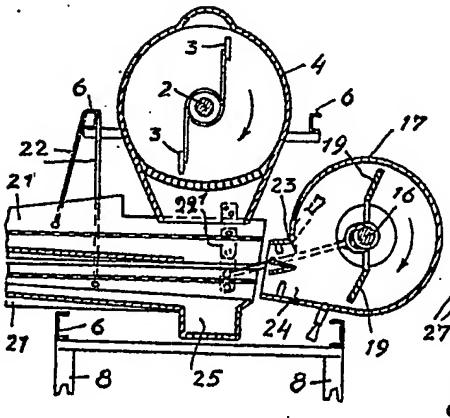
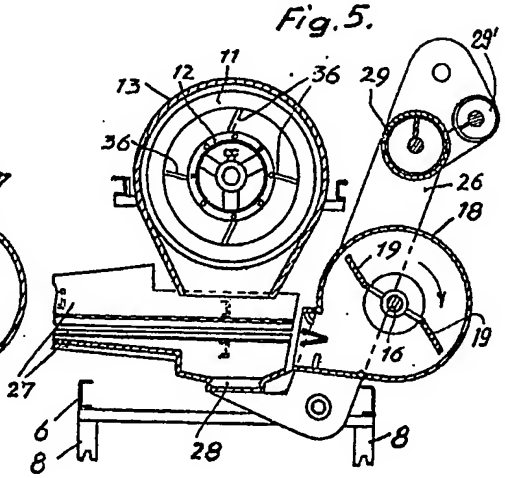


Fig. 5.



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3 SHEETS

SHEET 1

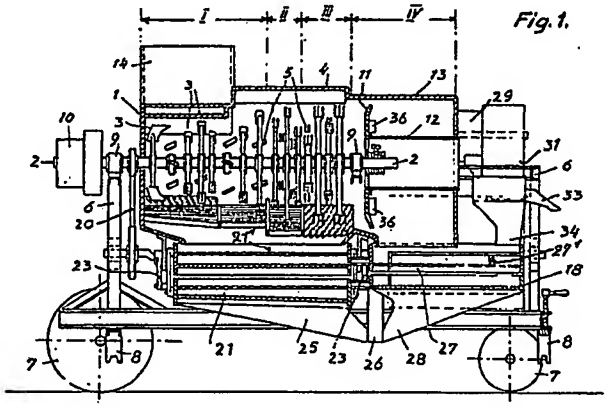

Fig. 1.

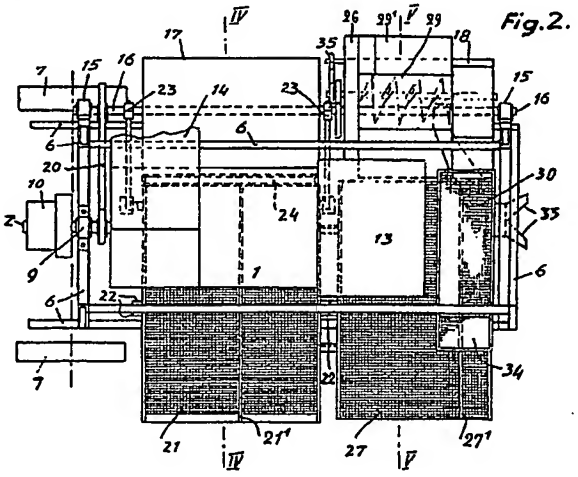

Fig. 2.

SHEET 2

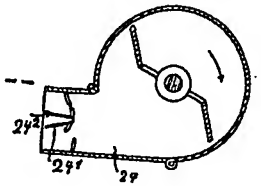

Fig. 4a

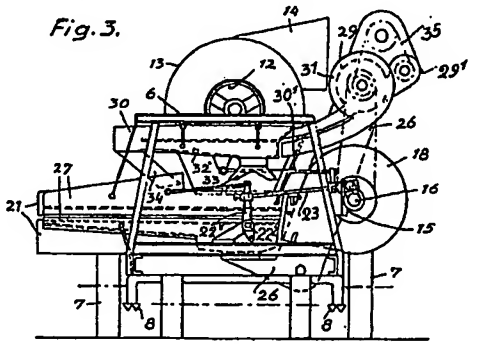

Fig. 3.

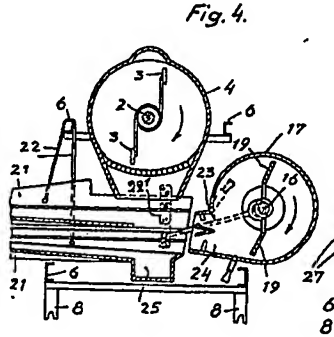

Fig. 4.

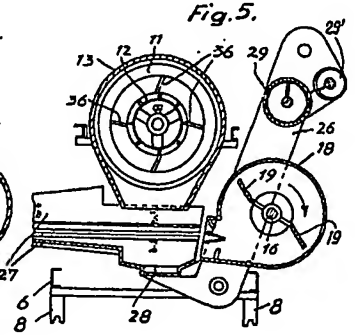

Fig. 5.

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Fig. 6.

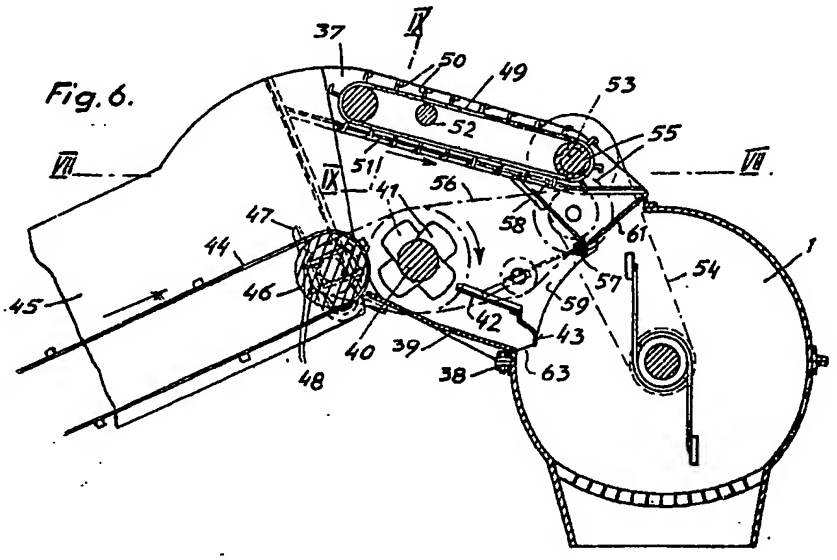


Fig. 7.

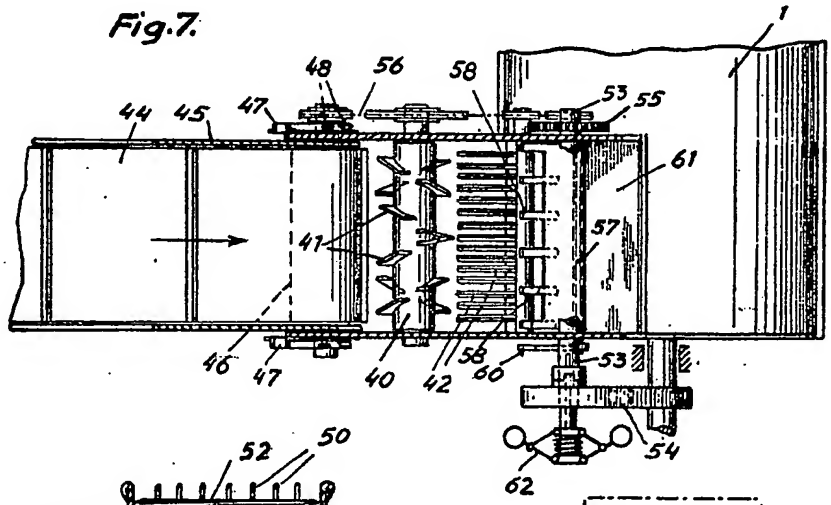


Fig. 9.

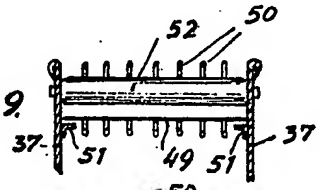


Fig. 10.

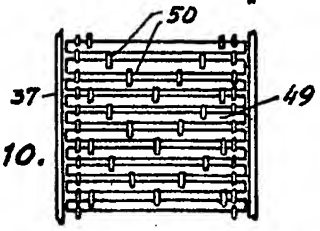
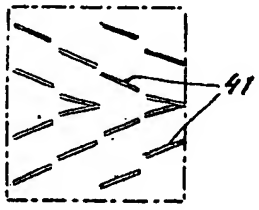


Fig. 8.



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